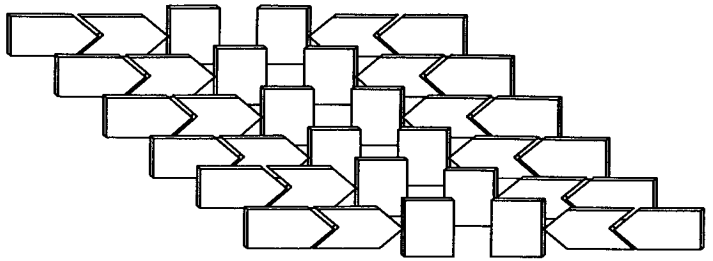
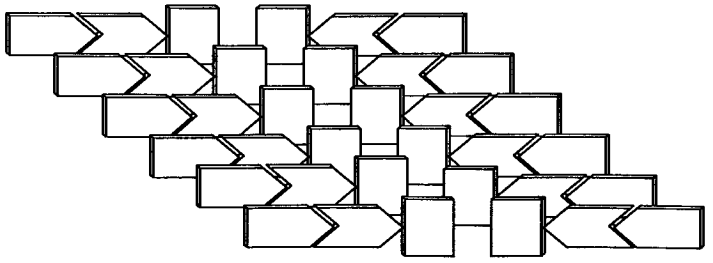


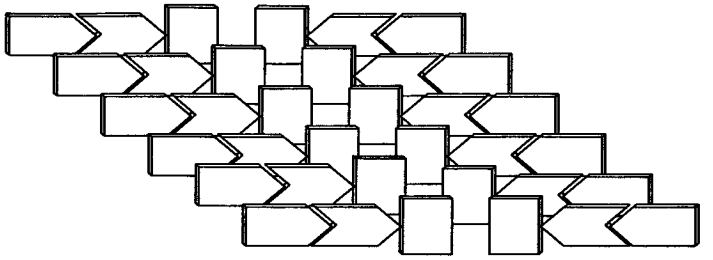
PCIX32

PCI Bus Isolation Extender

User's Manual

Rev F





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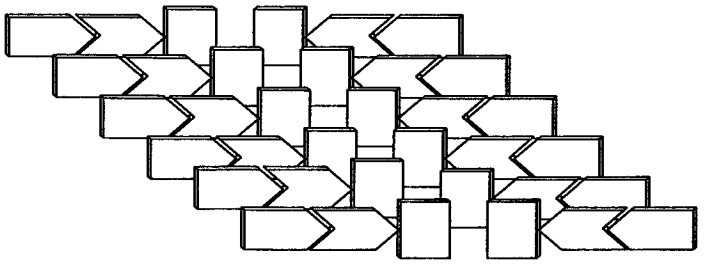

PCIX32
PCI Bus Isolation Extender

User's Manual
Rev F

PREFACE

PCIX32 is a 32 bit Peripheral Component Interconnect (PCI) bus isolation extender. It allows PCI adapter boards to be added or removed from the PCI system bus without having to power down the system. It offers time and labor cost savings in product development and production board testing. It also serves to protect the motherboard from being damaged during testing.

Operation of the PCIX32 extender can be controlled by on-board toggle switch or by external TTL input signal. User is required to provide initialization routines to restore the state of the board under test during successive testing.

Product Options:

-T for additional connector at right angle (on A side of the board).
-H for additional header pins at right angle (on B side of the board).
-5 for 5V VIO version.
-3 for 3.3V VIO version.

Related Products:

PCISX4	PCI 32 bit wearout extender
PCIOX4	PCI 32 bit offset extender
PCIEX4	PCI 32 bit extender
PCILX4	PCI 32 bit tall extender
PCITX4	PCI 32 bit right/left angle extender

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PRODUCT SPECIFICATION

Bus:	PCI (Peripheral Component Connect) 32 bit bus.
Power:	+5V with 4.0 amp slow blow plug fuse. +3.3V with 4.0 amp slow blow plug fuse. +12V with 1.6 amp slow blow plug fuse. -12V with 1.6 amp slow blow plug fuse. Plus short circuit sensing logic on +5, +3.3 and +12V.
Control:	Single toggle switch or external TTL controls.
Signal Delay:	Less than 500 picosecond (250 picosecond max. through the buffer).
Environment:	0-60 degree C (operating and storage).
Dimension:	Length 7.75 inches; Height 2.3 inches; Width 0.6 inches (dimension not including mounting bracket).

PRODUCT FEATURES

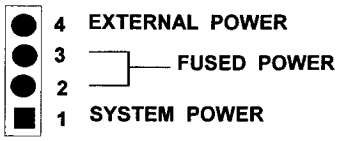
- Total power and signal isolation.
- No disturbance to the system bus during bus isolation and reconnection.
- Less than 500ps signal delay (isolation buffer + trace delay).
- Minimum voltage drop.
- Single switch operation or external TTL control signals.
- Allows external input voltage margin and current measurement.
- Over voltage and over current protection on power lines.
- Pluggable fuse allows easy replacement and change to other types and values of fuses.
- System power on, green LED indicator.
- Isolated power on, green LED indicators.
- Short circuit sensing on +5, +3.3 and +12V with auto power shut off.
- Reset pulse generation during power on.
- Flashing operating red status LED.
- Two-tone adjustable volume speaker for board status.
- Optional header pins for logic analyzer hook up.
- Supports low cost wearout extender.
- Optional connector at right angle.
- Quality multilayer construction.

PCIX32 OPERATING INSTRUCTIONS

1. Insert the extender into a PCI expansion slot on a PCI motherboard. Secure the extender to the system enclosure with mounting bracket.
2. Power up the system, SW1 switch can be in either position, all green LEDs should light to show the state of the isolated power.
3. Test the extender by switching the SW1 switch up and down. The red LED should be flashing with SW1 in up position, indicating bus connection. The speaker should buzz approximately once per second. Adjust the volume of the speaker via the trim pot by the speaker.
4. **Add or remove add-on boards to the extender, only when the SW1 switch is in down position, the LED is not flashing and the speaker is not buzzing (bus isolated).**
5. Run test to the add-on boards with SW1 switch in the up position.
6. To make current measurements without the fuse, remove the corresponding plug fuse and place an ampere meter across pin 1 and pin 3 of the fuse socket pins. To make measurement with the fuse, insert fuse at pin 2 and pin 4 of the socket pins, and connect the ampere meter across pin 1 and pin 4 of the fuse socket pins.
7. To make voltage margin tests without the fuse, remove the corresponding plug fuse and connect external voltages to pin 3 of the socket pin and connect external ground to system ground. To make voltage margin with the fuse; move fuse to pin 2 and pin 4 of the socket pins and connect external power to header pins, on top of the fuses (see detail in Voltage Margin section).
8. The green LEDs at the upper left hand corner indicate the status of the isolated power. If not lit, check the corresponding fuses and replace them accordingly.
9. To remove the adapter boards from the extender, one should be careful not to lift the extender out of its system expansion slot. Keep the extender down while removing the adapter board and make sure the extender is turned off.

FUSE and PIN HEADER DEFINITION

Fuse Socket



F5	+5V	**F3**	+3.3V
F12	+12V	**F-12**	-12V

External Power Input

W9.1	+5V	**W10.1**	+3.3V
W6.1	+12V	**W7.1**	-12V

Pin 1 of W9, W10, W6 and W7 jumpers are connected directly to Pin 4 of F5, F3, F12 and F-12 fuse sockets. All pin 2s are Ground.

Low Isolated voltage detection jumper

LV5	isolated +5V	**LV3**	isolated +3.3V
LV12	isolated +12V		

Remove the LV jumpers to disable detection of individual low isolated voltage condition.

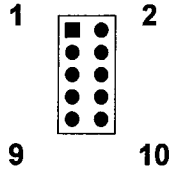
Speaker Jumper, W2

Jumper in - Speaker will buzz at approximately once per second, during normal operation, while bus signal and power is fully connected. It will also generate a continuous tone if logic detects a short circuit condition.

Jumper out - Speaker will not buzz during normal operation. However, it will still generate a continuous tone if logic detects a short circuit condition.

To adjust the volume of the speaker, turn the trim pot by the speaker. Turn counter clockwise to increase the sound and turn clockwise to decrease the sound.

W1 Pin Headers

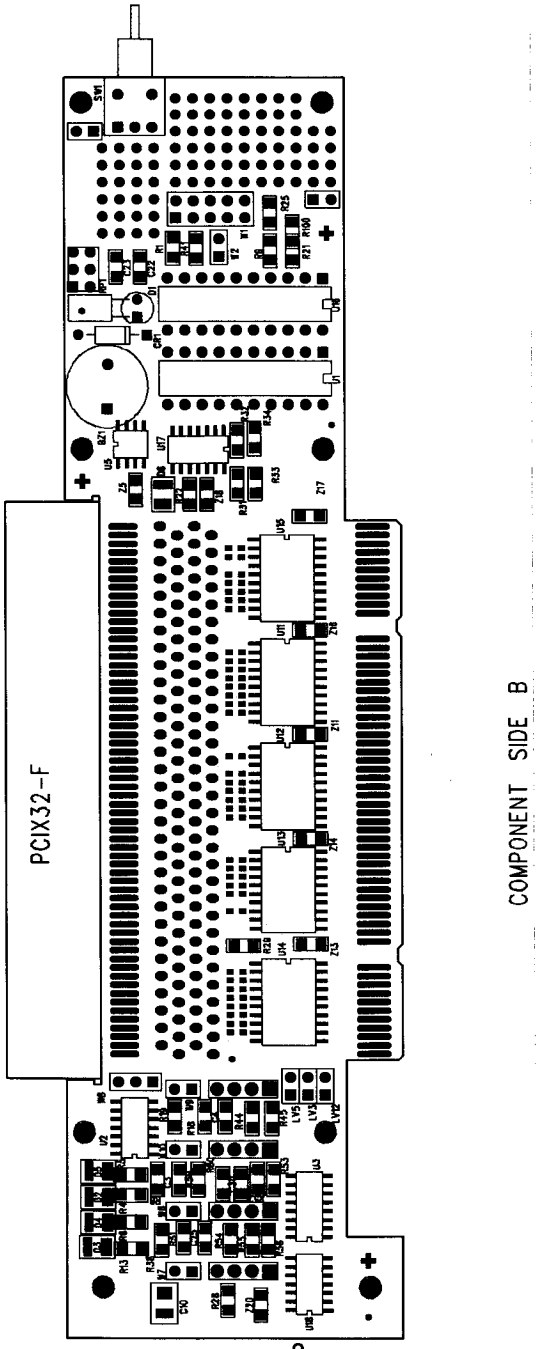


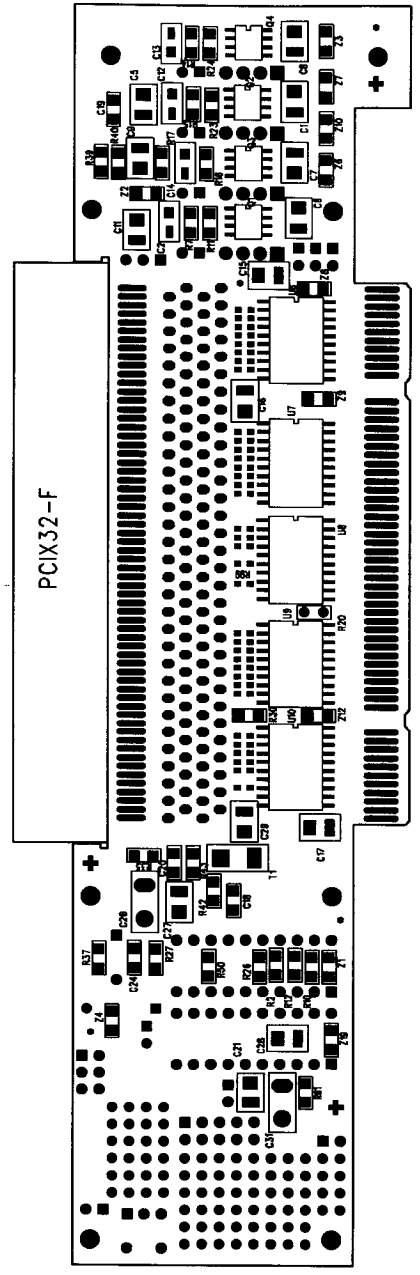
1	#Power_Control (Internal, Low enable)
2	+5V
3	#Signal_Control (External Input, Low enable)
4	Key
5	#Power_Control (External Input, Low enable)
6	Gnd
7	Gnd
8	Power_Control (External Input, High enable)
9	LED-
10	LED+ (5V at 25ma)

Pin 1 and pin 3 are jumped together in default to allow single toggle switch operation. Both power and bus signals are turned on together. User may connect an external toggle switch to pin 5 or an external TTL high signal to pin 8 to control the board.

To control the bus signals separately from the bus power, remove the jumper at pin 1 and pin 3 and connect external TTL control at pin 3. Power should be connected first, then the bus signals. The on-board toggle switch should be at down (off) position, if external TTL control is used.

External blinking LED can be connected between LED+ and LED- pins. LED- when low, is an indication of successful bus connection.





SOLDER SIDE A

THEORY OF OPERATION

The Bus Isolation Extender provides bus signals and power isolation, between the system motherboard and the add-on board, on top of the extender. The signals are isolated using state of the art analog switches, that allows bi-directional signal flow. When the analog switches are turned on, the bus signals are connected. The analog switch provides no signal "buffering". This means, the bus signals are not reconditioned at TTL levels, nor are they redriven by any active amplifier. Any AC/DC signal loading on the add-on board will have a direct effect on the signal lines of the system motherboard. The analog switch introduces less than 250 picoseconds delay to the signals.

The power isolation is implemented using MOSFETs. The MOSFETs are biased to allow slow ramping up of current, through the Bus Isolation Extender, to the add-on boards without causing a power surge or glitch to the system power. When the extender is turned on, a delay of approximately 22ms is introduced. This happens before the logic samples the voltage of power lines on the add-on board, thus making sure it reaches within 15%. The logic will then turn on the analog switches, to connect the bus signals. When the Bus Isolation Extender is switched off, or if the voltage drops below 15%, the logic on the extender board will disconnect the bus signals and shut down the power immediately.

User can select a Sync or Async method in connecting the signal buffers. In **Async mode (default, R20 & R100 out, R21 in)**, the buffers are connected about 24ms after power on, and the reset is deserted after another 6ms. In **Sync mode (R20 & R100 in, R21 out),** the logic synchronizes itself to the bus cycles. The buffers are connected three bus cycles after the 24ms power on delay. The reset is deserted 6ms after the buffers are connected. In addition, during system cold boot or anytime the system issues a reset while the bus is connected, the extender will pass that reset pulse to the add-on board, without disconnection or reconnection.

During normal operation, an on-board red LED will blink about twice a second, when the power and the signals are completely connected between the add-on board and the system bus. The speaker will also buzz about once a second.

If a short circuit condition occurs, or if the +5, +3.3 and +12 volts do not reach the operating voltage, within 22ms after the extender is turned on, the on-board logic will shut off the extender, the speaker will generate a loud continuous tone, and the red LED will be turned off. User will need to switch the extender off, to reset the short circuit logic. The short circuit logic can be disabled, for troubleshooting or in situations where the system's motherboard does not provide one of the voltage, such as the 3.3V. Removing the individual jumper at LV5, LV3, and LV12 location, will disable the sensing of the +5V, +3.3V and +12V respectively.

The add-on boards should be inserted or removed from the extender, only when the extender is switched off, the red LED is not blinking and the speaker is not buzzing. ***Serious damages to the system, extender and the add-on board could happen if the add-on board is inserted or removed while the bus is still connected.***

LOCAL and EXTERNAL CONTROL

The Bus Isolation Extender has a unique external control feature. This feature is very useful in the production environment and can be easily implemented in many ways. It allows an external toggle switch or TTL logic inputs to control the operation of the extender. When used with proper software, this feature helps to automate the test process, without requiring manual switching by the operator. The external control feature is accessible through the W1 header, located near the on-board toggle switch. The header is keyed for a ribbon type connector interface. The 2X5 header has the pins defined on page 7, under W1 Pin headers.

ON-BOARD TOGGLE SWITCH OPERATION

The on-board toggle switch operation is the default operation mode, as configured by the factory. This configuration allows single toggle switch operation, without any external connection. A jumper is installed between pin 1 and pin 3 of the W1 header. It requires an operator to manually toggle the switch up, for bus connection and toggle it down, for bus isolation. When the switch is toggled up, both the power and the signals are connected by the on-board logic.

EXTERNAL TOGGLE SWITCH OPERATION

An external toggle switch can be connected between pin 5 and pin 6 of the W1 header to simulate the on-board toggle switch. In this configuration, the on-board toggle switch should be turned off (down position) and the jumper remains in pin 1 and pin 3 of W1 header. The external switch can be mounted anywhere outside the chassis, for easier access. An external LED can also be connected through pin 9 and pin 10 of the W1 header. This will enable it to provide a status, outside the chassis. A blinking LED is recommended instead of regular LED. **The on-board LED and the toggle switch do not need to be removed** in this mode of operation.

EXTERNAL LOGIC CONTROL OPERATION

The Bus Isolation Extender can also be controlled by external TTL compatible signals. If the jumper remains on pin 1 and pin 3 of W1 header, a single TTL low control line, connecting to pin 5 or a TTL high signal to pin 8 of W1 header, can control both the power and signal isolation and connection. If the jumper on pin 1 and pin 3 of W1 header is removed, then two TTL control lines can be used to control the bus signals and the power separately. The TTL control line that connects to pin 5 or pin 8, will control the power. The TTL control line that connects to pin 3 will control the signal. The TTL control lines can come from any digital output source, such as the output pins of the parallel printer port, in the CPU system. If the external TTL control lines are from sources outside the same CPU system, the ground pins on pin 6 or pin 7, of the W1 header should be connected to the signal ground, of the external sources. The power control should be asserted first, then followed by the signal control.

Note that pin 5 allows a TTL low signal to power up the extender, while pin 8 allows a TTL high signal to power up the extender. For a system that requires the extender to be powered up from cold start, the user can choose from available sources of either an initial high or an initial low signal to bring the extender up. The on-board toggle switch needs to be at off(down) position, when external TTL signals are used, to control the extender.

CURRENT MEASUREMENT and VOLTAGE MARGIN

The PCIX32 Bus Isolation Extender is provided with pluggable slow blow fuses. Two 4.0 amp fuses are used for the +5V and +3.3V and two 1.6 amp fuses are used for the +12V, and -12V. In addition, a short circuit sensing logic is built-in to protect the system. The short circuit logic will sense shorts on +5V, +3.3V and +12V and automatically shut off the extender. The shorts can occur accidentally during test, or may already exist on the adapter board under test. In short circuit condition, the speaker will generate a loud continuous tone to alert the user. In normal condition, the speaker will buzz once a second and the red LED will blink twice a second, to alert the user that the Bus Isolation Extender is powered up and the bus is connected.

User can perform voltage margin to adapter boards, on top of the extender, by connecting external power to location W9, W10, W6, W7 (see pin definition on page 6) and by moving the pluggable fuses from position 1-3 to 2-4 location (see pin definition on page 6). When external power are applied through the fuses, the current are still controlled by the MOSFETs, which regulate the ramping of the voltage. All on-board logic still uses the power from the motherboard and is not affected by the external power.

Current measurement can be performed by removing the fuse and connecting an ampere meter across the fuse socket pins. Use socket pins 1-3 or 1-2 for current measurement from the motherboard and pin 2-4 or 3-4 for current measurement from the external power. The leads of the ampere meter should be kept as short as possible. This will avoid excessive voltage drop, which would cause the on-board short circuit logic to activate or malfunction of the adapter board.

User could remove the fuses of the unused power, to prevent unnecessary accidental damage. By doing this, the corresponding low voltage sensing logic should also be disabled (see detail in Theory of Operation and pin definition on page 6).

TROUBLESHOOTING AND SELF SERVICE

Since one of the primary uses of the Bus Isolation Extender is to protect the system's motherboard from being damaged by bad adapter boards under test, it is common for the Bus Isolation Extender to be damaged during operation. This is especially true in a production environment. Our experience has shown, two of the most common problems associated with the Extenders are blown fuses and blown buffer ICs. Such failures are usually caused by:

1. Users tend to accidentally pull the add-on boards while the bus is still connected. This happens most when the user is not yet used to the procedure, and occasionally forgets to switch the extender off, while removing the add-on board. One must observe the red LED to make sure it is not blinking, or listen to the speaker, before adding or removing the add-on board. Otherwise the user will cause the fuses and the buffer ICs to blow, especially, the one has signals next to the power pins. This is caused because the add-on board may be removed at an angle, which will short the power pins to the nearby signal pins.

2. The extender is lifted or wiggled side to side, while the add-on board is being removed or added. This will happen if the extender is not tied down firmly. It is very important for the user to find an appropriate way to hold down the extenders, using brackets or fixtures in an open or closed chassis environment. Since the Bus Isolation Extender is still connected to the system bus, it will cause sparking in both power and signal pins. This will most likely damage the buffer ICs.

3. Shorted power to signal pins or signal to signal pins on the add-on board. This condition will usually cause an overload to the buffer ICs and damage it. **Do not test the failed add-on board on the Bus Isolation Extender again until the cause is corrected.**

4. Extender connector pins are damaged or not making good contact due to wearout or rough handling. We strongly recommend the use of Wearout Extender PCISX4, especially in the production environment.

We recommend the following steps for the user's self troubleshooting and field testing, before returning the extender for factory service.

1. Check the extender connector pins for any physical damage and correct them if possible.

2. Check the fuses for continuity and if need be, replaced them.

3. Check for all isolated power to ground short.

4. Visually inspect the buffer ICs for physical cracks, burn marks, etc. When the buffer IC is damaged, it will usually smoke while the bus is being connected. The damage could be caused by sparking or ESD from previous operation. Replace the damaged buffer ICs and try again.

5. Check the extender power up sequence, without the adapter board on top of the extender. To isolate whether the problem is in the extender itself, or with the adapter board, make sure the buzzer and the red LED is operating properly.

Our experience has shown that, the buffer ICs at four corners, are most likely to be damaged in the operation. This is especially true when user forgets to turn off the extender before removing or adding the adapter board. Adex Electronics, will assist customers over the phone, to locate the damaged components and recommend further actions. Adex Electronics, can also provide the components as spare parts to the customers. Each bus isolation extender is provided with a bag of spare parts, to include 2 fuses of each type and 2 buffer ICs, for on-site repair. For further service information, latest parts list and updates, please refer to our Service section, at our web site: **http://www.adexelec.com**.

BOARD INITIALIZATION

Bus Isolation Extender isolates power and bus signals between the add-on board and the motherboard. Each time the toggle switch is turned off, the power to the add-on board is lost. Therefore, the information in the registers and memory, on the add-on board will also be lost. For the next add-on board to be tested, the add-on board will need to be reinitialized, after the powers are reconnected. User will need to develop an initialization routine to restore the information back to the add-on board, before running the test. It can be done in a batch file, where the initialization routine is placed, before the test routine. The initialization routine can search for a previous saved configuration file and use it to reinitialize the add-on board. The test software should display the test results and messages. This will tell the operator when to remove and add another board for test, and how to restart the test. A sample **re-initialization program (AXINIT01.EXE)** is available on our website under our Software section. The extender itself does not require any software to operate, it is totally hardware controlled.

Every time the Bus Isolation Extender is powered back on, the on-board logic will generate a reset signal to the add-on board under test, during reconnection. For manual toggle switch operation, the user should wait until the red LED is blinking, before reinitialization. In an automated system, the initialization software should sense the **LED- signal (at W1.9)** at logic low state for at least twice contiguously to confirm the bus is reconnected , before re-initializing the adapter board. During disconnect, the user should wait for the red LED to stop blinking, before removing the add-on board under test. In a software control operation, the LED- should be sensed high at least twice contiguously before putting out messages to remove the adapter board. **In Sync mode**, the bus isolation extender uses the FRAME# signal of the PCI bus to synchronize the operation. Normally, during the memory refresh cycle, the FRAME# signal will appear on the bus. In some systems, this may not be true. If this is the case, the user should then issue at least 4 dummy PCI bus cycles following the 24ms delay after the extender is switched on. After the bus is switched off, the user will also need to issue at least one dummy PCI bus cycle, so the extender can properly resync itself for the next operation.

MOUNTING OF BUS ISOLATION EXTENDER

The Bus Isolation Extender incorporates very fast CMOS buffers for isolation of bus signals, between the add-on board and the motherboard. These CMOS buffers are extremely sensitive to voltage spikes and can be easily damaged by Electrostatic Discharge (ESD) or any sparking due to intermittent contacts. It is necessary for users in the production environment to mount the Bus Isolation Extender, firmly against a common platform where the motherboard is mounted. For in chassis testing, a fixture or a bracket should be developed to hold the Bus Isolation Extender to the chassis. For an out of chassis environment, the user should tie the motherboard and the Bus Isolation Extender down, against a common platform. Whatever fixture or bracket design is used, one should not allow the Bus Isolation Extender to be lifted with the add-on board. Also, the extender should not be wiggled side to side.

Appendix

USING PARALLEL PORT as EXTERNAL TTL CONTROL

The following information on the PC/AT parallel ports is provided for users, who wish to use the parallel port pins as the TTL control lines to the Bus Isolation Extenders.

1st Parallel Port: Data Register = 378; Status Register = 379;
Control Register = 37A; IRQ = 7

2nd Parallel Port: Data Register = 278; Status Register = 279;
Control Register = 27A; IRQ = 5

Data Register: Bit 0 - 7 = Data Bit 0 - 7

Status Register:	**Control Register:**
Bit 7 = /BUSY	Bit 7 = N/A
Bit 6 = /ACK	Bit 6 = N/A
Bit 5 = PE	Bit 5 = N/A
Bit 4 = SLCT	Bit 4 = IRQ_ENABLE
Bit 3 = /ERROR	Bit 3 = SLCT_IN
Bit 2 = N/A	Bit 2 = /INIT
Bit 1 = N/A	Bit 1 = AUTO_FEED
Bit 0 = N/A	Bit 0 = STROBE

The female 25 pin parallel port pin outs are:

1	/STROBE	(output)	14	/AUTO_FEED	(output)
2	Data 0	(I/O)	15	/ERROR	(Input)
3	Data 1	(I/O)	16	/INIT	(output)
4	Data 2	(I/O)	17	/SLCT_IN	(output)
5	Data 3	(I/O)	18	Gnd	
6	Data 4	(I/O)	19	Gnd	
7	Data 5	(I/O)	20	Gnd	
8	Data 6	(I/O)	21	Gnd	
9	Data 7	(I/O)	22	Gnd	
10	/ACK	(Input)	23	Gnd	
11	BUSY	(Input)	24	Gnd	
12	PE(Input)		25	Gnd	
13	SLCT	(Input)			

Note

1. /STROBE, BUSY, /AUTO_FEED, /SLCT_IN are inverted by Hardware (1 in software will appear as low at pin).
2. During power up, parallel port pins /STROBE, /AUTO_FEED, /SLCT_IN are reset to logic high; and /INIT is reset to logic low. After BIOS initialization, /INIT is toggled to high and /SLCT_IN is toggled to low.
3. Depending on the sequence of the BIOS initialization in each CPU system, one can use any of the signal pins (low or high) to bring the extender up during cold boot. In some systems, an extra soft reboot by Ctrl Alt Del, after the first power up, may be necessary to get the plug and play boards to be recognized by BIOS.
4. The LED- pin on the W1 header on the Bus Isolation Extender could be connected to the SLCT pin, on the parallel port (pin 13) as status input. The LED- at low, will indicate successful bus connection and at high, indicates no signal connection. The #Power_Control at pin 1 of the W1 header can also be used as a positive indication of cable connection and power connection. It may also be connected to the BUSY pin, of the printer port.
5. Some CPU systems may relocate the parallel port I/O addresses or may use 3BC-3BF as the 1st parallel port /O addresses. One may verify the I/O addresses by looking at memory location, 0:408, ROM BIOS data areas, using the DOS debug command.

PCI BUS PINOUT

COMPONENT SIDE B	PIN NO.	SOLDER SIDE A
-12V	01	TRST#
TCK	02	+12V
GND	03	TMS
TDO	04	TDI
+5V	05	+5V
+5V	06	INTA#
INTB#	07	INTC#
INTD#	08	+5V
PRSNT1#	09	Reserved
Reserved	10	+VIO
PRSNT2#	11	Reserved
KEYWAY(3.3V)	12	KEYWAY(3.3V)
KEYWAY(3.3V)	13	KEYWAY(3.3V)
Reserved	14	Reserved
GND	15	RST#
CLK	16	+VIO
GND	17	GNT#
REQ#	18	GND
+VIO	19	Reserved
AD[31]	20	AD[30]
AD[29]	21	+3.3V
GND	22	AD[28]
AD[27]	23	AD[26]
AD[25]	24	GND
+3.3V	25	AD[24]
C/BE[3]#	26	IDSEL
AD[23]	27	+3.3V
GND	28	AD[22]
AD[21]	29	AD[20]
AD[19]	30	GND
+3.3V	31	AD[18]

Note: +VIO is +3.3V in PCIX32-3 version.
+VIO is +5V in PCIX32-5 version.

PCI BUS PINOUT

COMPONENT SIDE B	PIN NO	SOLDER SIDE A
AD[17]	32	AD[16]
C/BE[2]#	33	+3.3V
GND	34	FRAME#
IRDY#	35	GND
+3.3V	36	TRDY#
DEVSEL#	37	GND
GND	38	STOP#
LOCK#	39	+3.3V
PERR#	40	SDONE
+3.3V	41	SBO#
SERR#	42	GND
+3.3V	43	PAR
C/BE[1]#	44	AD[15]
AD[14]	45	+3.3V
GND	46	AD[13]
AD[12]	47	AD[11]
AD[10]	48	GND
M66EN / GND	49	AD[09]
KEYWAY(5V)	50	KEYWAY(5V)
KEYWAY(5V)	51	KEYWAY(5V)
AD[08]	52	C/BE[0]#
AD[07]	53	+3.3V
+3.3V	54	AD[06]
AD[05]	55	AD[04]
AD[03]	56	GND
GND	57	AD[02]
AD[01]	58	AD[00]
+VIO	59	+VIO
ACK64#	60	REQ64#
+5V	61	+5V
+5V	62	+5V

Note: +VIO is +3.3V in PCIX32-3 version.
+VIO is +5V in PCIX32-5 version.

WARRANTY

Adex Electronics, Inc. warrants this product against defects in material and workmanship for a period of 90 days, from the date of purchase. During the warranty period, Adex Electronics, Inc. will repair or replace this product at no charge. This warranty does not apply if the product has been damaged by accident, abuse, misuse or misapplication, nor as a result of service or modification made by others.

Adex Electronics, Inc. is not responsible for incidental or consequential damages resulting from use of this product. This includes damages to property and personal injury. The information in this manual has been carefully checked and is believed to be accurate. However, if there are any inaccuracies in this manual, Adex Electronics, Inc. assumes no responsibility for any damages resulting from any omission or defects in this manual.

Caution! Handle and store this product in an electrostatic safe environment. ESD could damage this product.

Adex Electronics, Inc. reserves the right to make changes in future product design, without reservation and without notification to its users.

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